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Quantifying Carbon Processes of the Terrestrial Biosphere in a Global Atmospheric Inversion

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The role of land ecosystems as sources or sinks of carbon in response to human perturbation is not well understood given the spatial heterogeneity and the temporal variability of the biospheric CO_2 exchange (Ciais et al., 2000). Therefore, understanding and quantifying the role of the land biosphere in the global carbon budget is necessary, particularly the response and feedback of carbon [U+FB02]uxes to climatic controls. Atmospheric CO_2 measurements have played a key role in assessing source/sink distributions on global scales using atmospheric CO_2 inversions (top-down approach) (e.g. Enting et al. (1995); Kaminski et al. (2002); Bousquet et al. (2000); Rödenbeck et al. (2003); Baker et al. (2006)). Process-based models (bottom-up approaches) of carbon [U+FB02]uxes are also useful tools for exploring the underlying processes involved in the uptake and release of carbon in the terrestrial biosphere. These methods on their own are unlikely to provide enough information to fully understand the underlying processes driving the uptake and release of atmospheric CO_2 (Dargaville et al. 2005). Therefore, we developed a modeling framework that couples bottom-up and top-down approaches and uses different data constraints (atmospheric CO_2 concentrations, satellite-driven data, and climate data) in order to quantify the carbon sources and sinks of the terrestrial biosphere. This allows us to better understand the underlying processes by optimizing some internal key parameters of the biosphere model in order to [U+FB01]t the observed CO_2 concentrations.

In order to assess the impacts of the climate variability on the terrestrial carbon flux for different Spatial and temporal variability, the relationships between the spatial/temporal patterns of the optimized terrestrial carbon flux and the anomalies of the climate variables (e.g. temperature, precipitation, radiation) are analyzed.